

Illinois Storage Corridor

DE-FE0031892

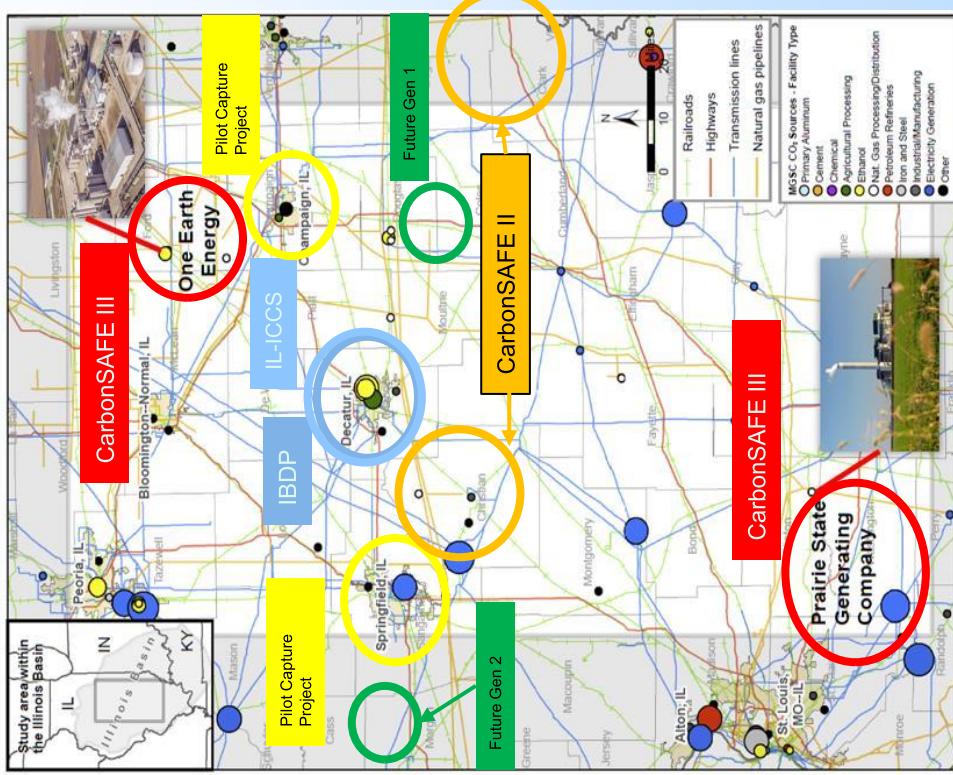
Steve Whittaker
Illinois State Geological Survey/
University of Illinois

U.S. Department of Energy
National Energy Technology Laboratory
2021 Carbon Management and Oil and Gas Research Project Review Meeting
August 2021

Presentation Outline

- Project Overview
- Environmental Impact Volume
- Risk Assessment
- Site Characterization
 - Drilling
 - Modeling
- UIC Class VI Permitting
- Carbon Capture Assessment
- Summary

Illinois Storage Corridor CarbonSAFE Phase 3



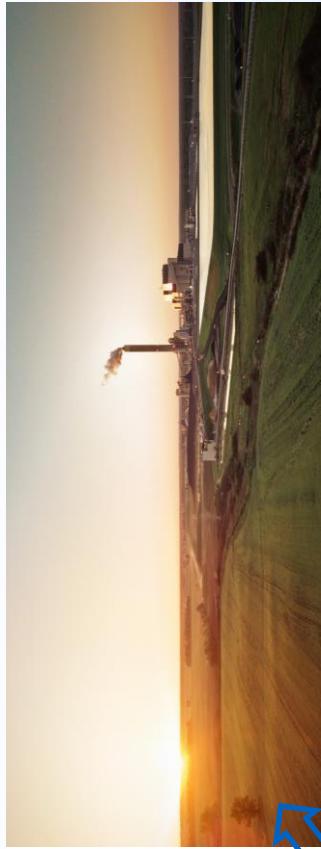
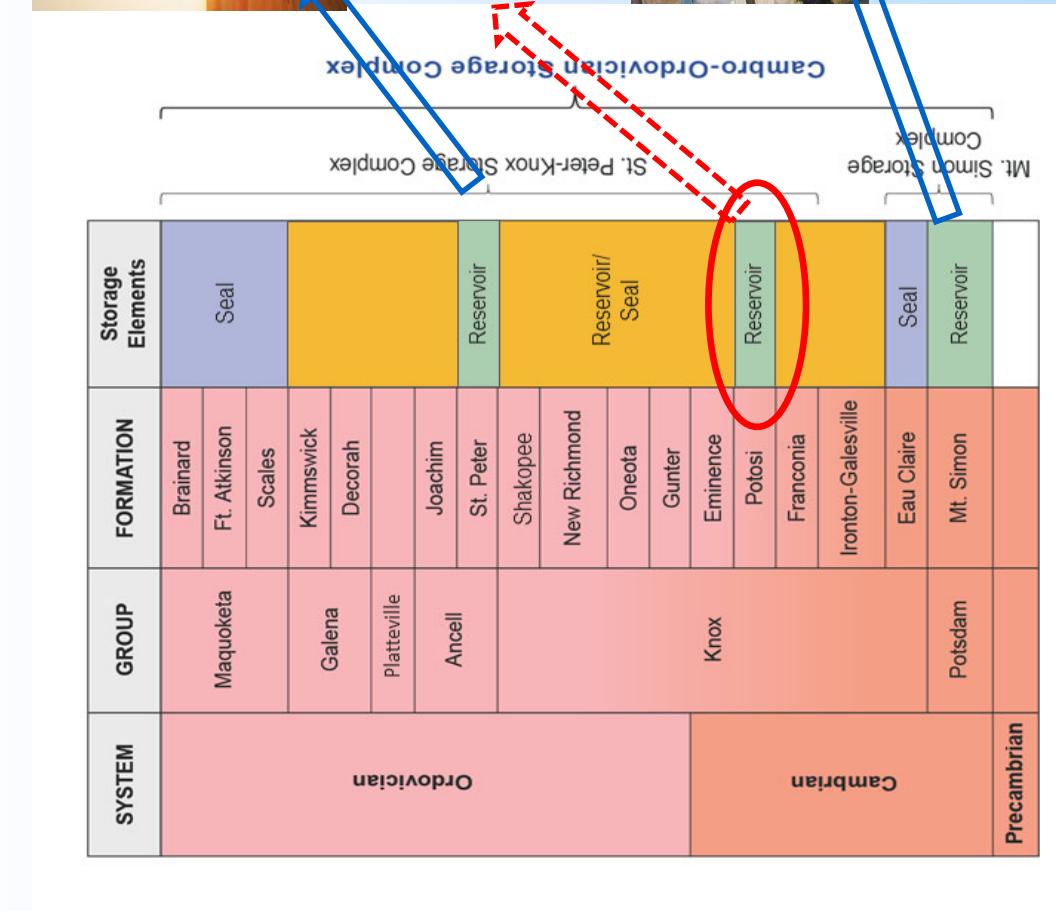
Illinois Storage Corridor is a region with significant previous CCS-related activity

Project builds upon IBDP, CarbonSAFE Phases 1 and 2 and many other studies.

2 separate sites will be investigated in different storage complexes
Ethanol source: Mt Simon Storage Complex – Storage HUB (0.5 to 1.7 MTPA CO₂)

Coal-fired power source: FEED study for capture +6 million tons CO₂ per year

Storage Development

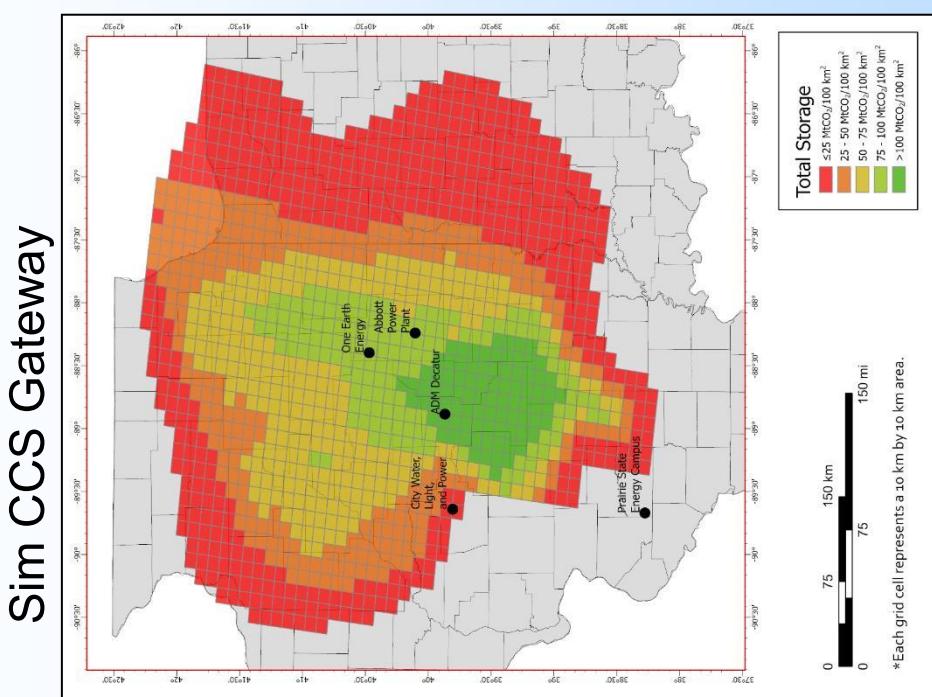


Prairie State – coal fired power station
commissioned 2012 1600 MW – 2 units
St Peter Storage Complex (ca 6 MTPA CO₂ from 1 unit)
Storage near site location



One Earth Energy – ethanol plant
Mt Simon Storage Complex – Storage HUB (0.45 to 1.7 MTPA CO₂)
Storage near site location

Lower Mt Simon Complex

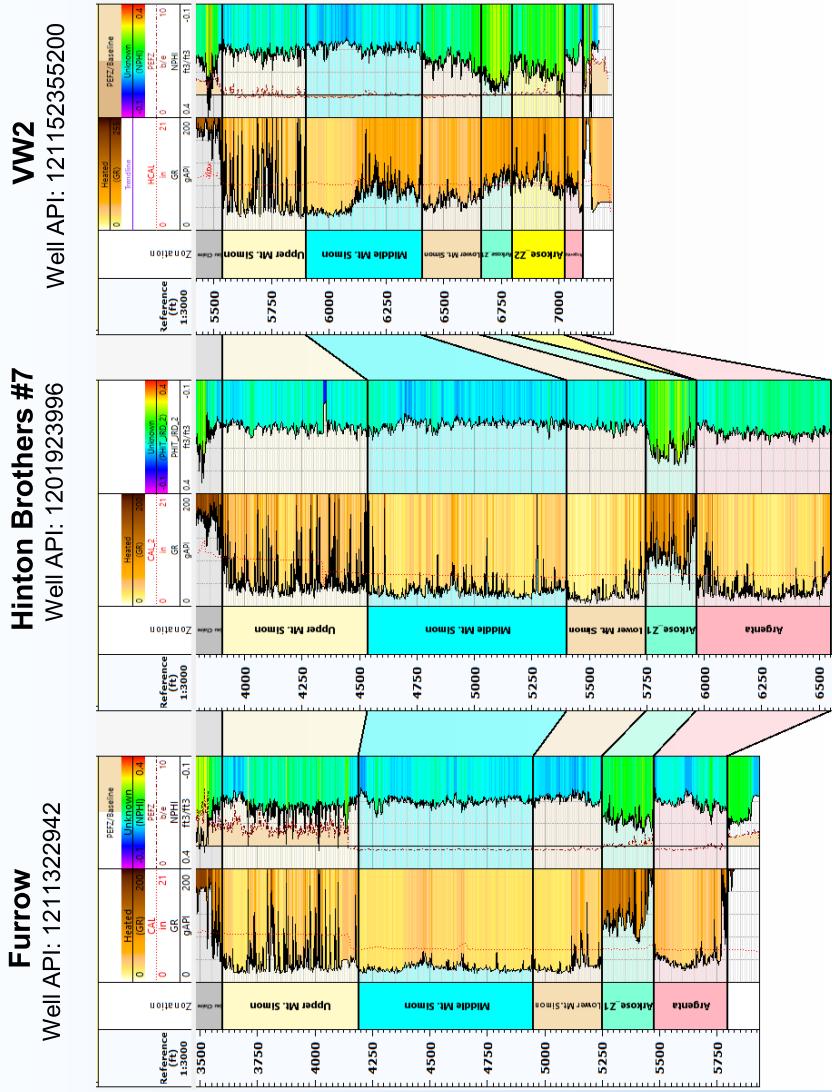
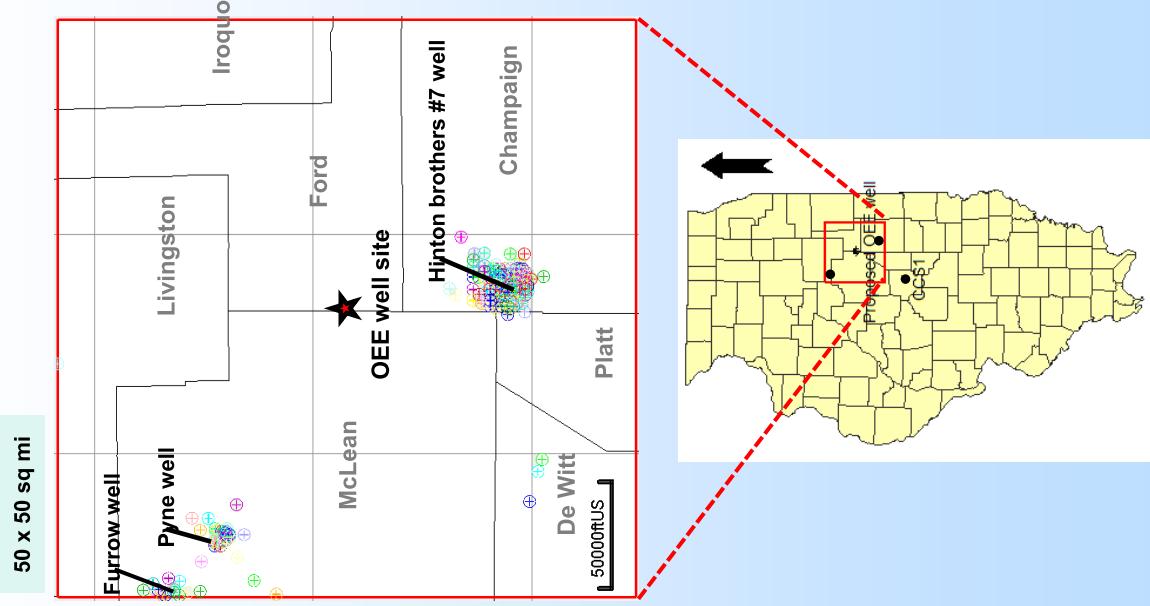


Estimates created using the Sequestration of CO₂ Tool (*SCO₂T*)
CarbonSAFE Macon County DE-FE0029381

Lower Mt Simon Sandstone net thickness (10% porosity cutoff)



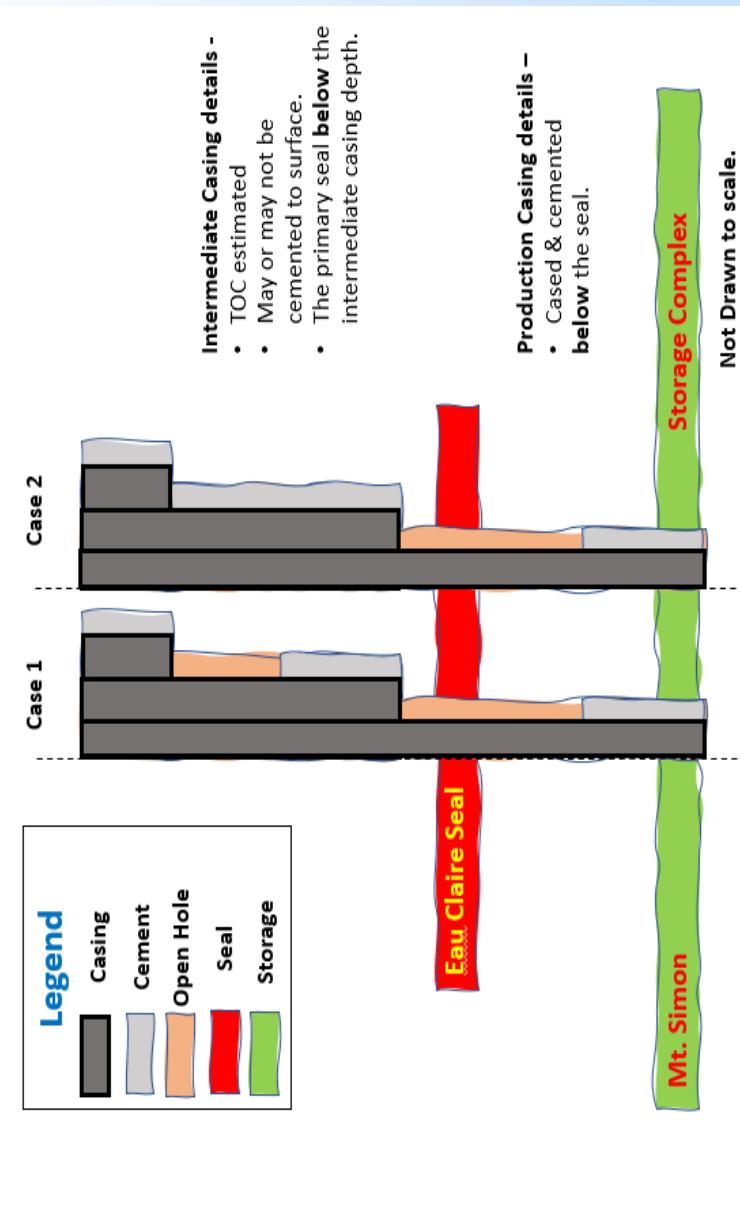
Static Model Framework



Legacy Well Identification and Evaluation

Well configuration considered to be Level 2 Risk

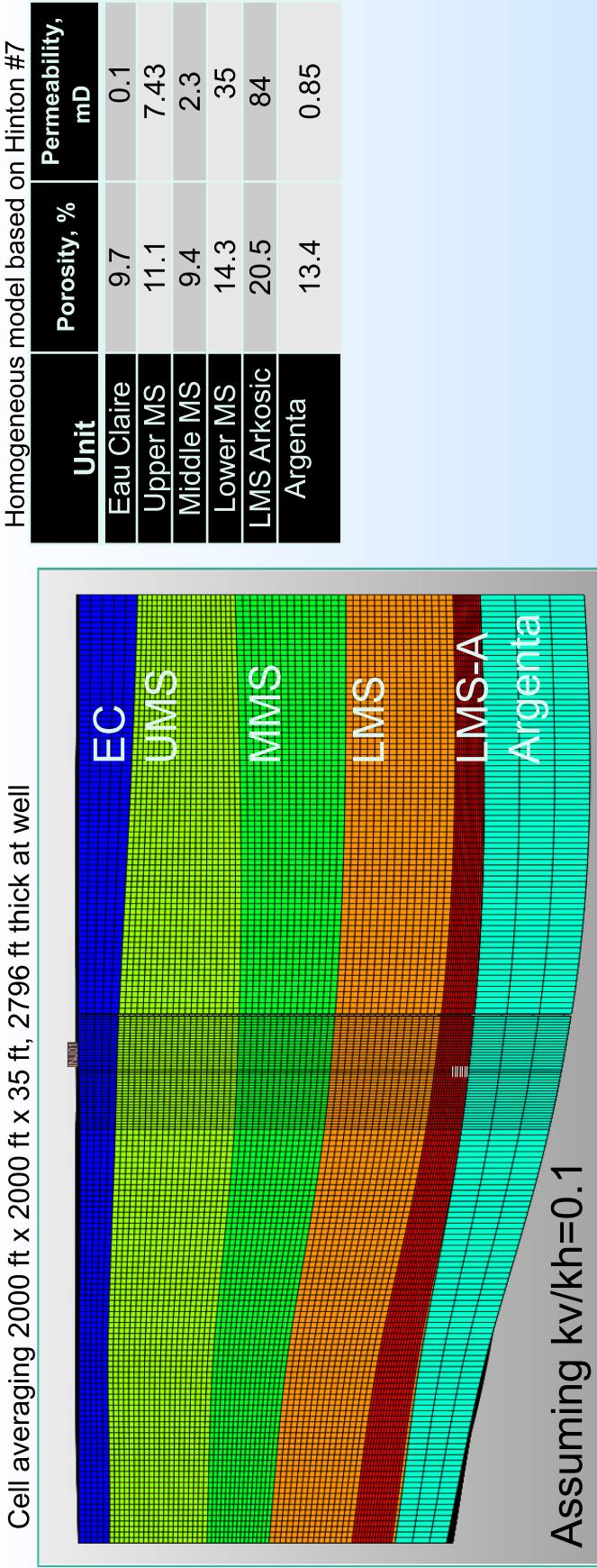
Surface Casing : Assumed to be cemented to surface if TOC is not specified.



Risk Level	Description	# of Wells within 15 mi radius
Level 1	High risk	1
Level 2	Medium risk	1
Level 3	Low risk	149

Early One Earth Geocellular model

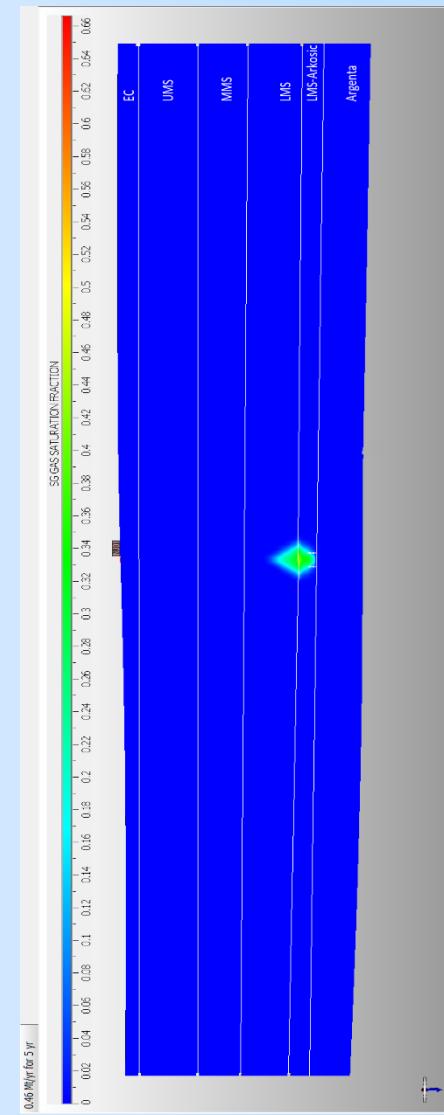
Cell averaging 2000 ft x 2000 ft x 35 ft, 2796 ft thick at well



Homogeneous model based on Hinton #7

Unit	Porosity, %	Permeability, mD
Eau Claire	9.7	0.1
Upper MS	11.1	7.43
Middle MS	9.4	2.3
Lower MS	14.3	35
LMS Arkosic	20.5	84
Argenta	13.4	0.85

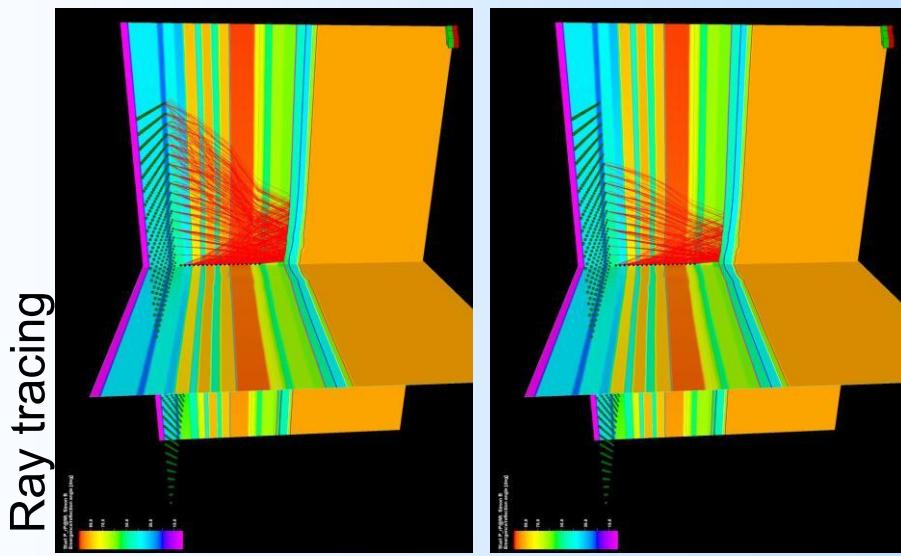
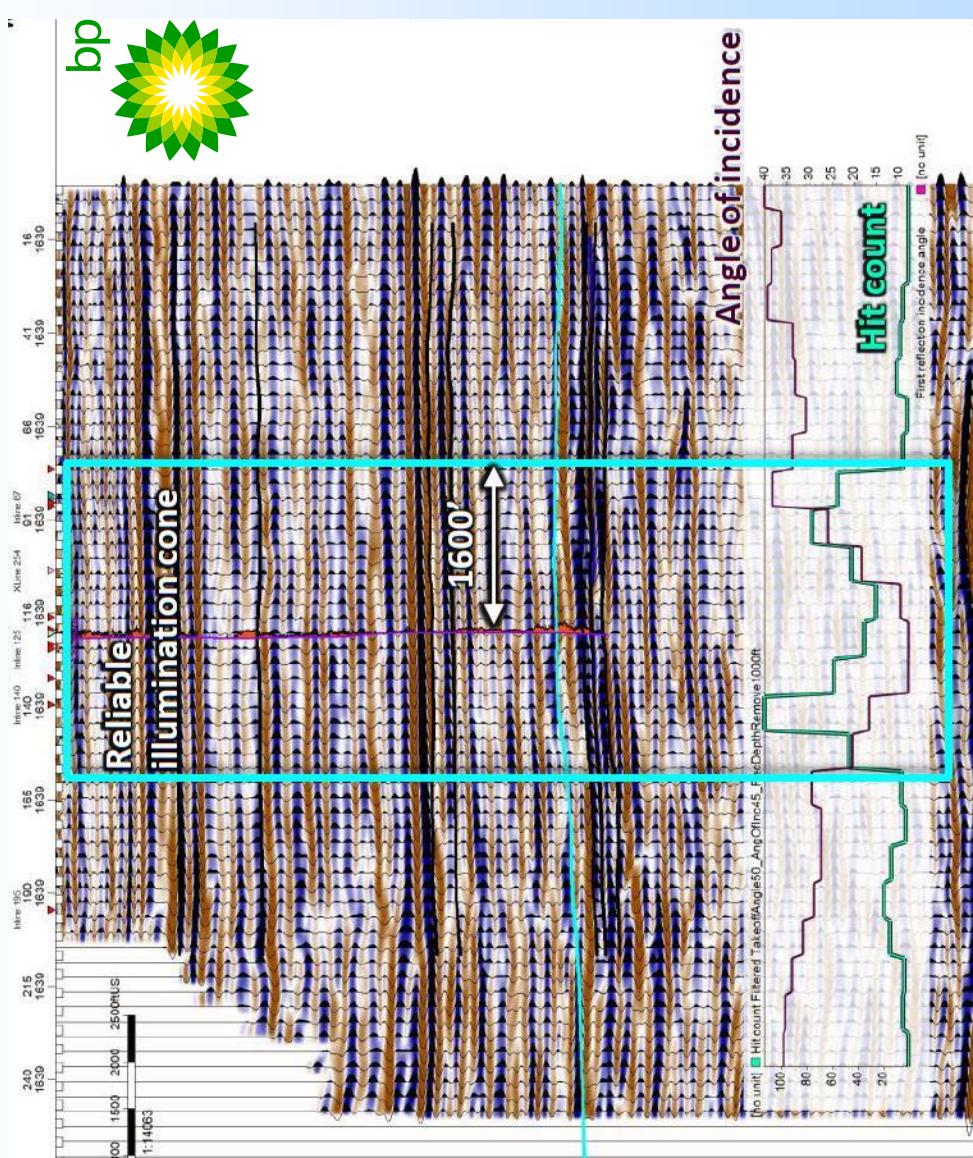
CO₂ plume at 5 years:



0.46 Mt/yr: 2000 ft (0.38 mi)
in radius, 560 ft in height

2 Mt/yr: 3500 ft (0.66 mi) in
radius, 761 ft in height

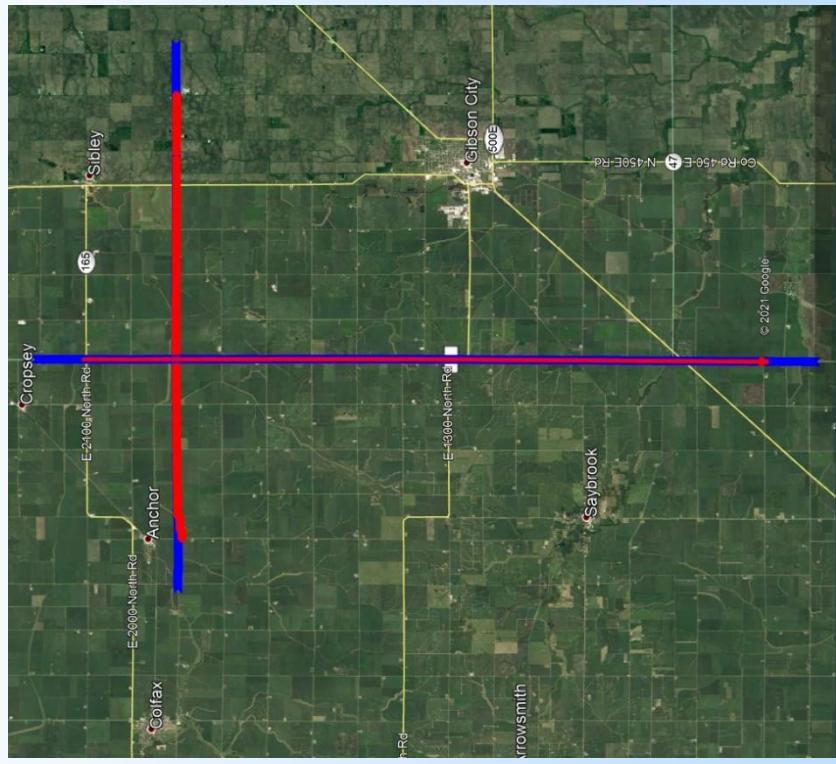
Evaluation of DAS for plume imaging



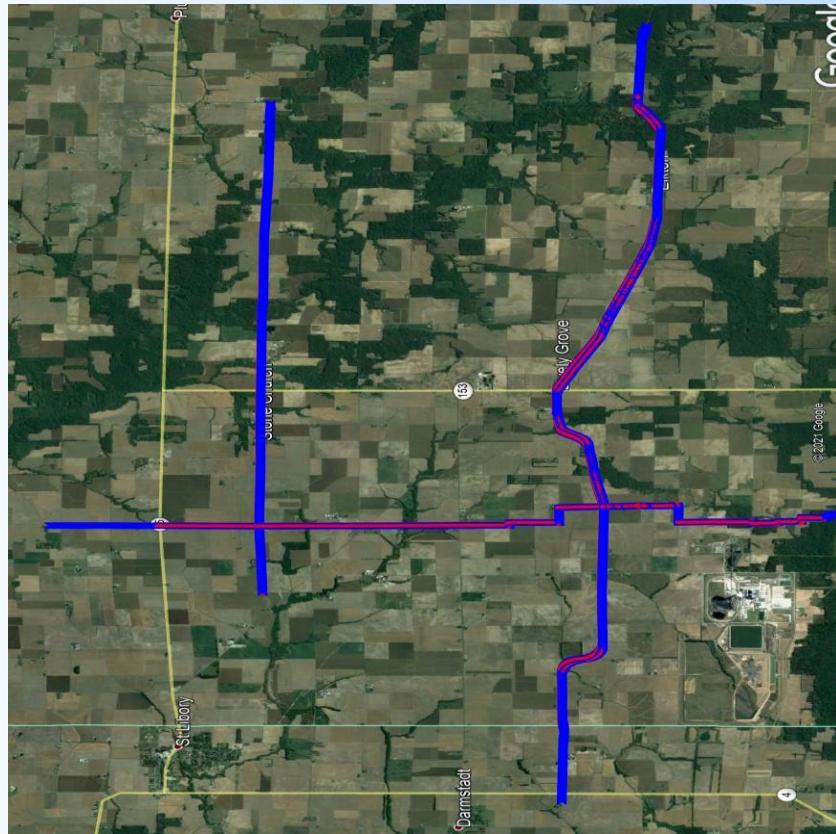
Successive filtering of rays
based on reflection and
intersecting angles

2D Seismic Surveys

One Earth area



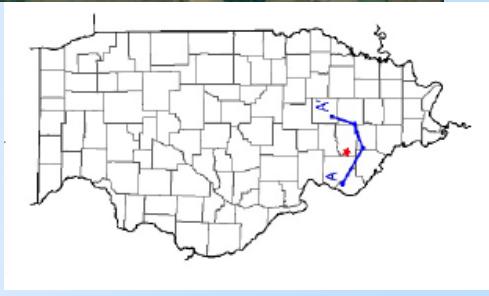
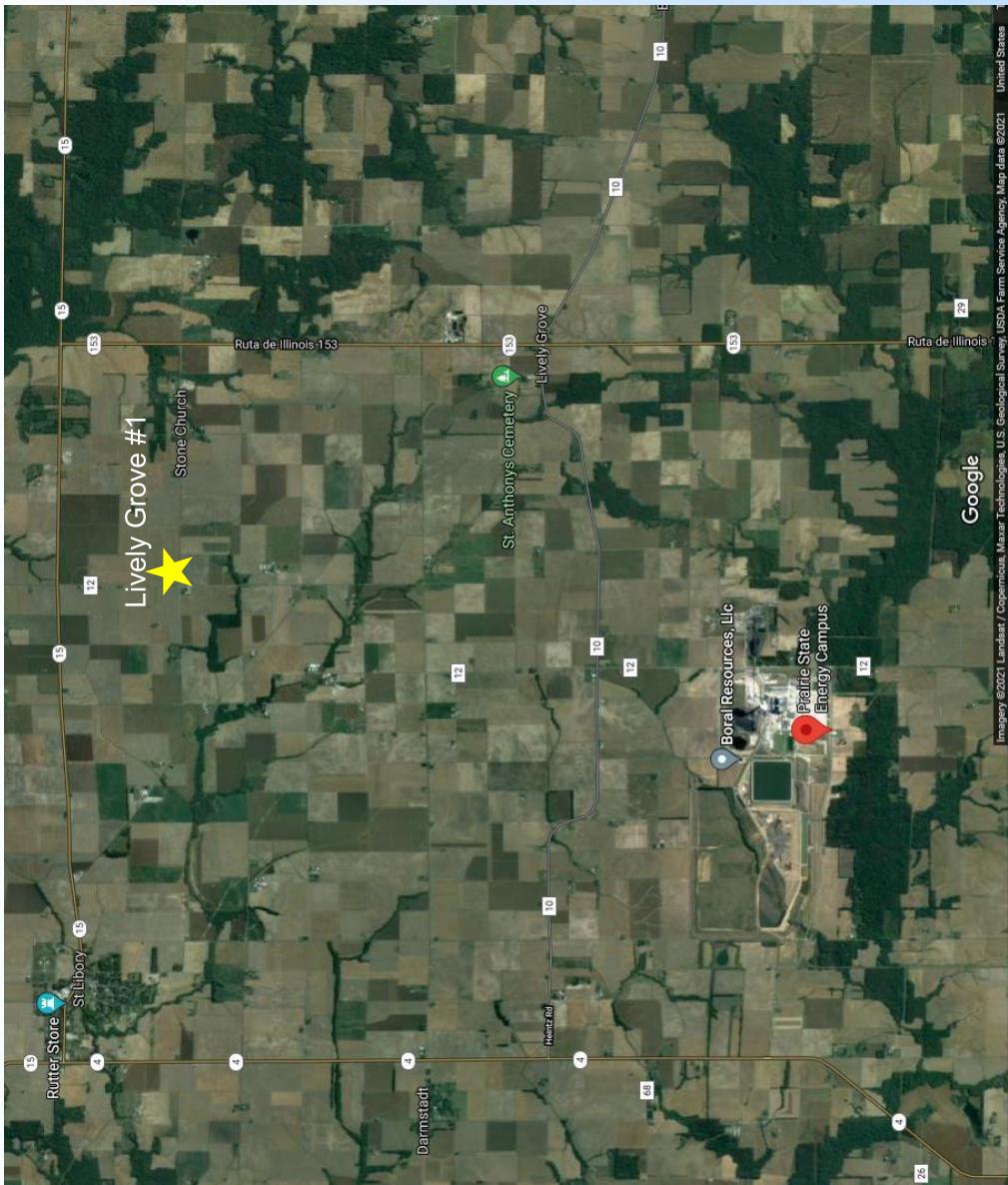
Prairie State Area



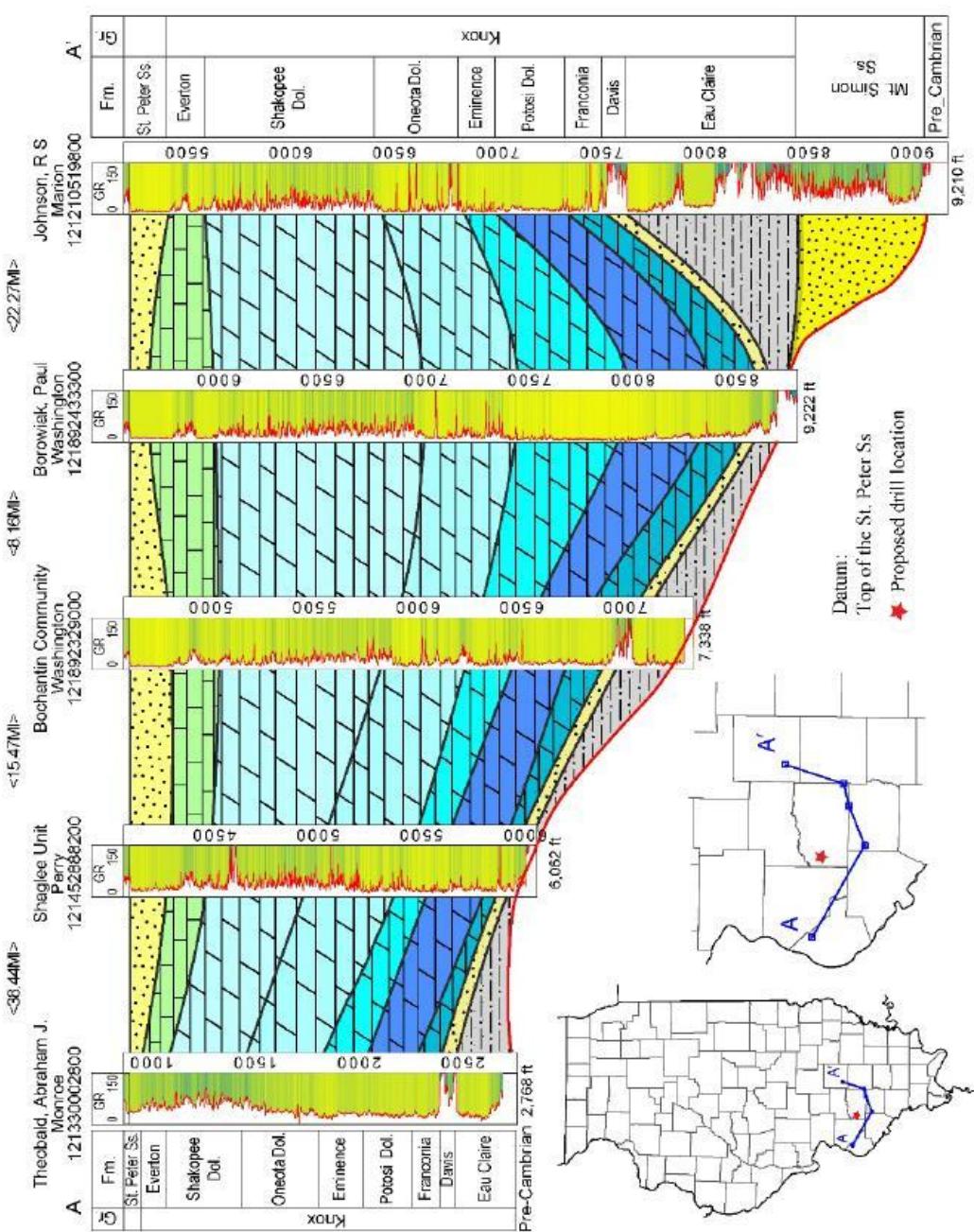
~25 miles 2D at each location using Stryde nodal receiver system

Prairie State Storage Site

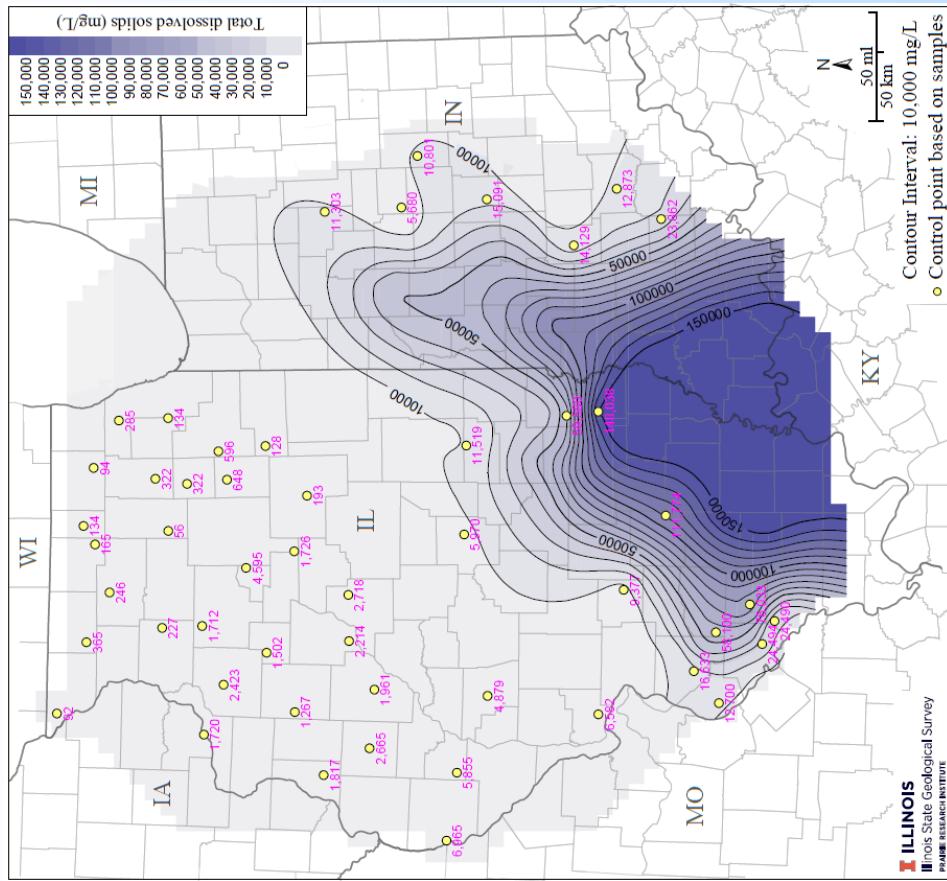
- Capture FEED study
- 6MTPA CO₂
- Rural Setting
- Lively Grove #1 test well site
~ 6 miles north of plant



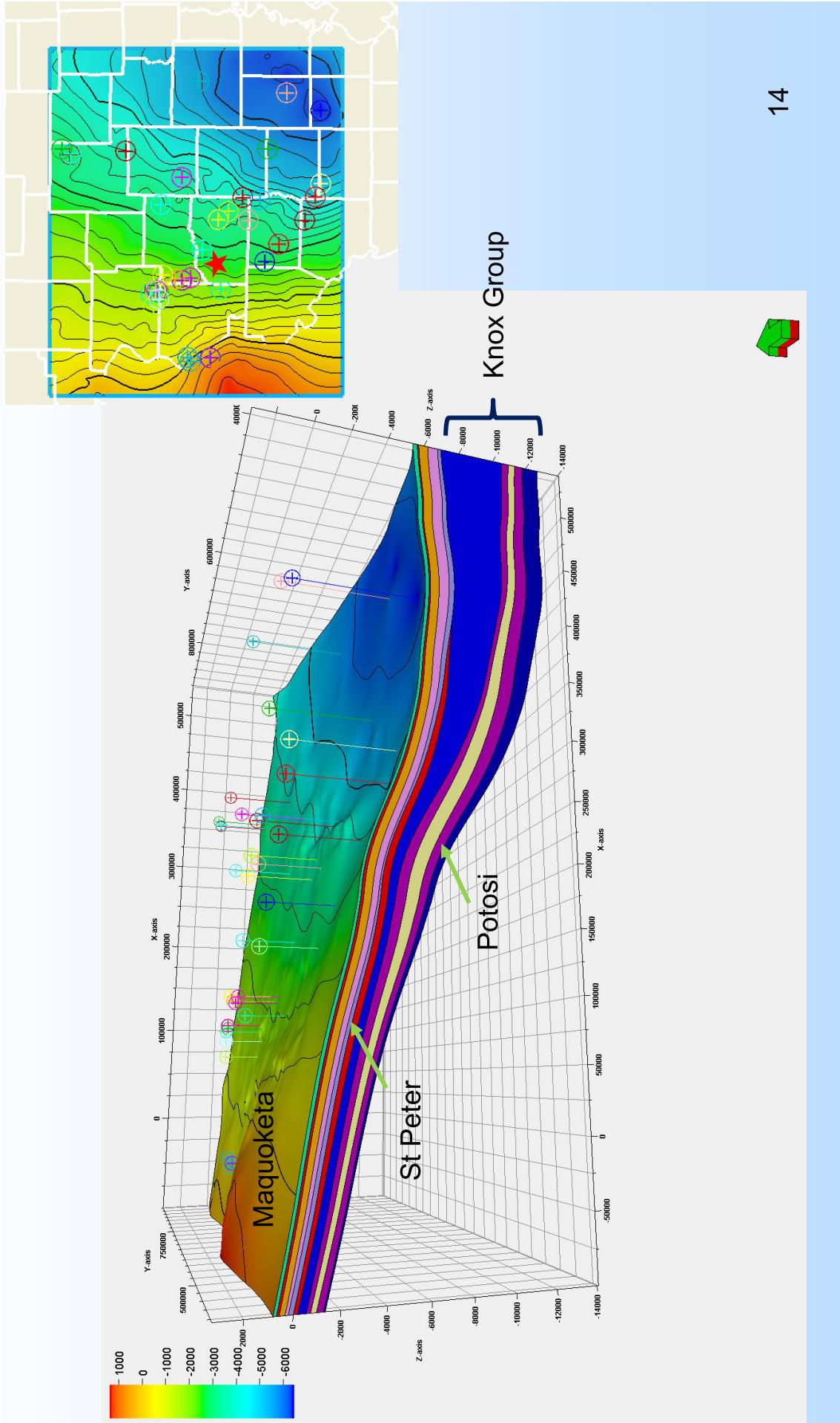
Prairie State Characterization



St Peter TDS



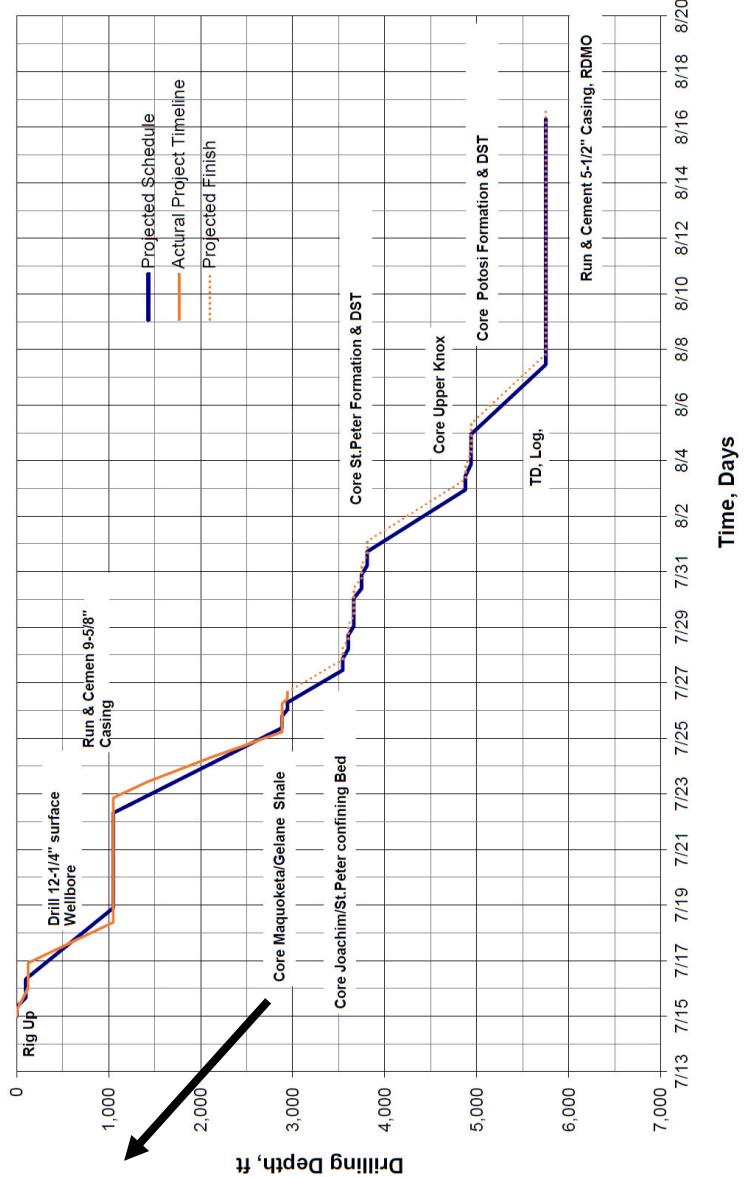
Regional Stratigraphic Framework



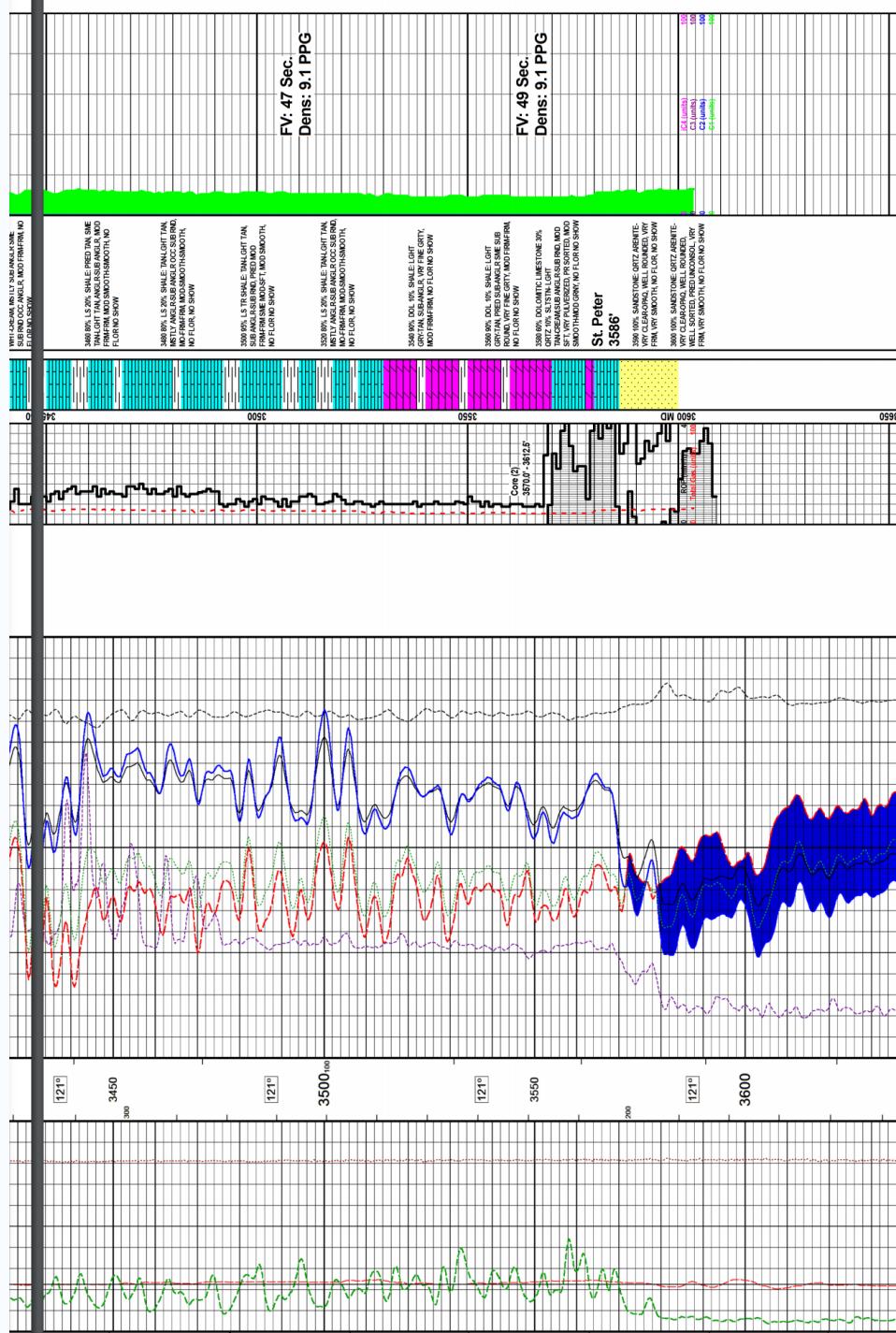
Lively Grove #1



Prairie State Generating Company- Lively
Grove Well #1 Proposed Drilling Timeline



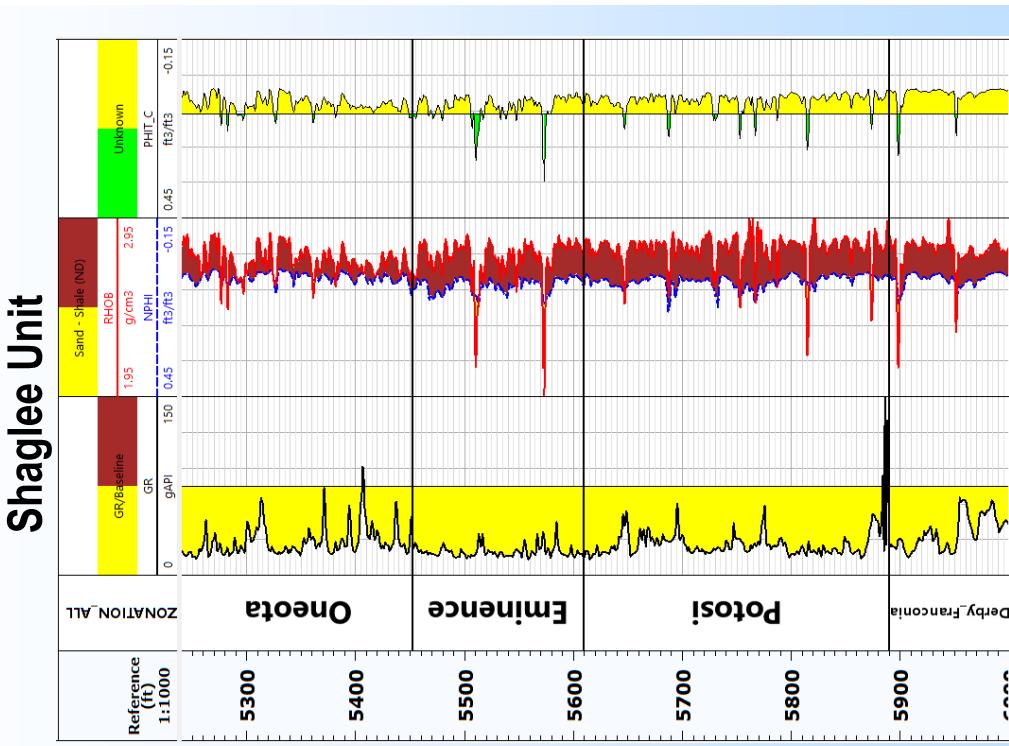
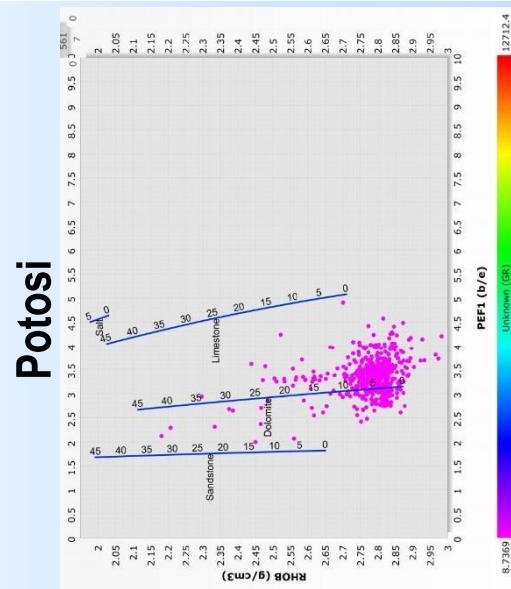
First Contact: St Peter



Potosi Dolostone (2ry target)

Thickness and porosity range

Well	Formation	Gross (ft)	Net (ft) Cutoff: 10% Porosity
1214528888200	Eminence	157	32.5
1214528888200	Potosi	280.33	22



CO₂ Capture Assessment

Full-Scale FEED Study For a 816 MWe Capture Plant at the Prairie State Generating Company Using Mitsubishi Heavy Industries of America Technology



DE-FE0031841 / Pittsburgh, PA / November 13, 2019

Kevin C. O'Brien

Director, Illinois Sustainable Technology Center and Illinois State Water Survey

ILLINOIS **PRALINE STATE**
Generating Company
Prairie Research Institute

Kiewit **MITSUBISHI**
HEAVY INDUSTRIES AMERICA

- The PSGC plant was commissioned in 2012 and uses pulverized coal and super critical technology to run at high temperatures and pressures.

- Two 800-megawatt power units produce over 12 million tons of CO₂ annually.
- Capture of this CO₂ will be based on the KM CDR Process™ CO₂ capture technology from Mitsubishi Heavy Industries (MHI).



- OEE produces ethanol and approximately 450,000 tons/yr of relatively pure CO₂ byproduct.
- An engineering Pre-FEED study for capture at OEE is being conducted with site specific design considerations
- Trimeric and AECOM are leading this effort



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AECOM

Class VI Submittals

- Site Characterization data:
- Area of Review (AoR) and Corrective Action Plan:
- Injection Well Construction Plan:
- Plans for Pre-Operational Testing:
- Proposed Injection Well Operations Plan:
- Proposed Monitoring Plan:
- Proposed Mechanical Integrity Testing (MIT) Plan:
- Proposed Injection Well Plugging Plan:
- Post-Injection Site Care, and Site Closure Plan (PISCP):
- Emergency and Remedial Response Plan (ERRP):

Accomplishments to Date

- Submitted EIV and are addressing comments
- Pre-drilling site characterization
- Legacy well risk database and identification
- Drilling well: Lively Grove #1
- Submitted permit to Illinois DNR for well at One Earth
- 2D seismic surveys permitted (to start August 16)
- Static models being developed
- Class VI permit writing in progress
- Process documents for capture at One Earth Energy being developed
- Coordinating with FEED study at Prairie State

Synergy Opportunities

- DE-FE0031841 is conducting a FEED study for capture at the Prairie State Generating Station that directly links with the CarbonSAFE Illinois Storage Corridor project
- Work performed under CarbonSAFE projects FE0029831 (Macon County) and FE0031626 (Wabash) are providing contributions to geological and infrastructure knowledge

Project Summary

- Pre-Drilling Site Characterization conducted
- Environmental Impact Volumes in revision
- Lively Grove #1 being drilled for characterization data
- One Earth #1 being permitted
- 2D Seismic surveys permitted and will start in mid-August
- Modeling in early stages
- Risk Assessment iterative
- Capture Assessment at One Earth in progress
- Data being compiled and integrated into Class VI permit templates

Project Team



INDIANA GEOLOGICAL
& WATER SURVEY
INDIANA UNIVERSITY



BRIGHAM YOUNG
UNIVERSITY



ILLINOIS
Sustainable Technology Center
ILLINOIS SUSTAINABLE TECHNOLOGY CENTER
PRAIRIE RESEARCH INSTITUTE



CO₂ CRC
BUILDING A LOW
EMISSIONS FUTURE



GEOSTOCK
ENTREPRENEUR



bp



A SUBSIDIARY OF ALBERTA INNOVATES

Appendix

- These slides will not be discussed during the presentation, but are mandatory.

Benefit to the Program

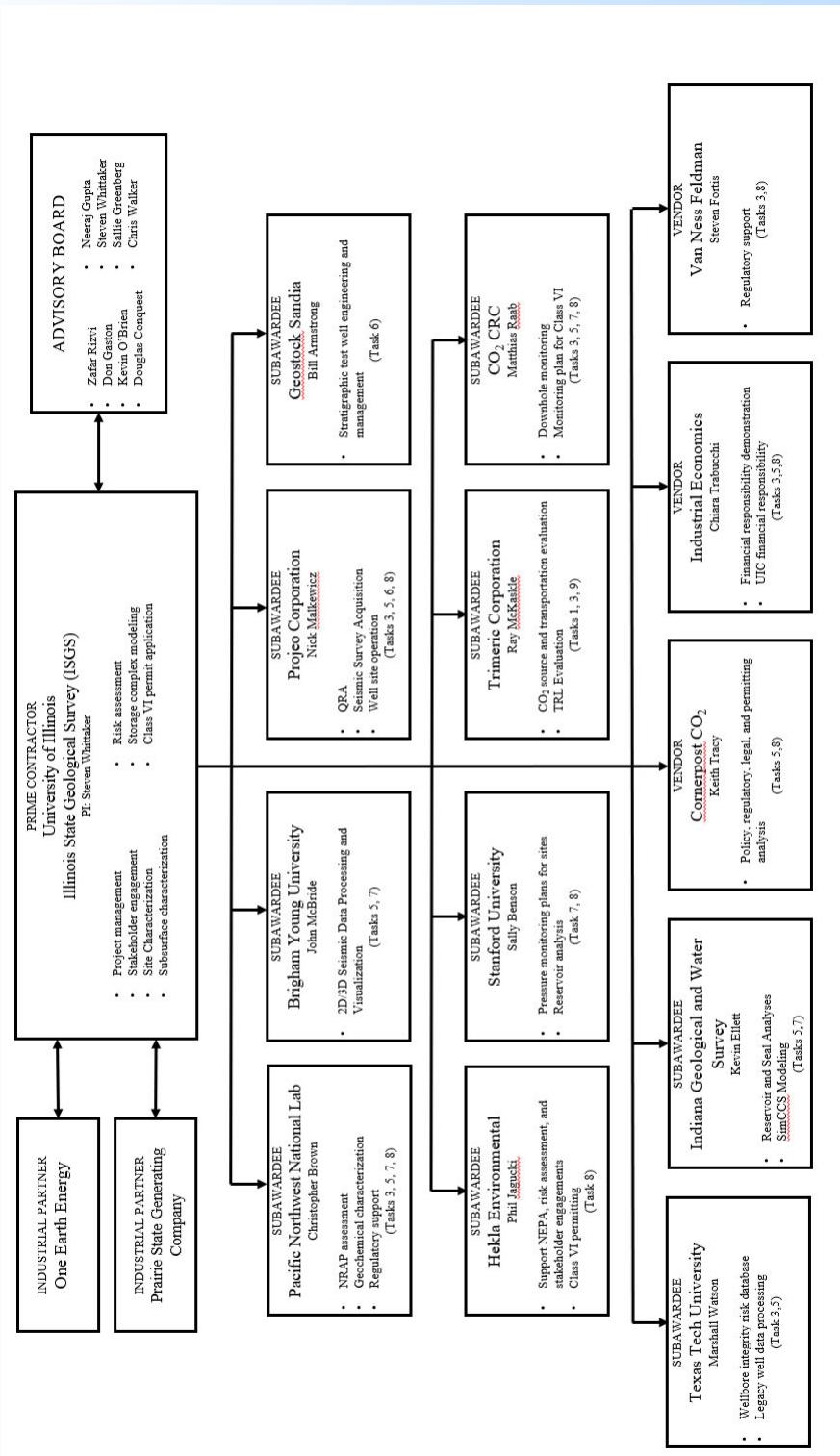
- CarbonSAFE Program goals being addressed:
 - Identify & characterize geological storage complexes to store > 50 million tonnes CO₂ within 30 years, and;
 - accelerate deployment of CCUS at commercial scale including understanding of how to safely, efficiently and cost effectively characterize and permit project sites.
- Project benefits.
 - Characterization will establish storage resources at 2 specific sites and have broader regional implications
 - Provide basis for development of storage hub(s)
 - Work will provide leadership for other industrial/energy sources and initiate further development in the region and elsewhere
 - Linkage with capture program

Project Overview

Goals and Objectives

- Illinois Storage Corridor Objectives
 - Mature and prove CCS at commercial scale by performing subsurface characterization and related work to enable submission of 2 Class VI permit applications, and gain approval for construction of CO₂ injection wells at 2 sites in different storage complexes.
- CarbonSAFE Phase III program objectives:
 - acquisition, analysis and development of information to characterize a storage complex and demonstrate storage resources for commercial volumes of CO₂.
 - identification of a storage site(s) within the storage complex,
 - preparation and submission of an Underground Injection Control (UIC) Class VI permit to construct

Organization Chart



Gantt Chart

- Provide a simple Gantt chart showing project lifetime in years on the horizontal axis and major tasks along the vertical axis. Use symbols to indicate major and minor milestones. Use shaded lines or the like to indicate duration of each task and the amount of work completed to date.

Gantt Chart

Table 6. Gantt Chart with Team Responsibilities by Task. Letters refers to milestones in Table 3.

#	Task Name	Start	End	Budget Period 1				Budget Period 2				Subawardees				Vendors	
				2020	2021	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	PNNL	UIUC	ISGS	Trixmetric
1.0 Project Management and Planning																	
1.1 Project Management Plan	10/01/2020 09/30/2023	A												X			
1.2 Data Management Plan	10/01/2020 09/30/2023													X			
1.3 Technology Maturation Plan	10/01/2020 09/30/2022																
1.4 Manage All Project Activities, Objectives, and Milestones	10/01/2020 09/30/2023	B												X			
1.5 Knowledge Sharing	10/01/2020 09/30/2023																
1.6 Communications	10/01/2020 09/30/2023													X			
2.0 National Environmental Protection Act (NEPA)																	
2.1 Preparation and Submission of an Environmental Information Volume (EIV)	10/01/2020 03/31/2021													X			
2.2 Preparation and Submission of NEPA Documentation	10/01/2020 09/30/2021													X			
3.0 Risk Assessment																	
3.1 Quantitative Risk Assessment	10/01/2020 09/30/2023													X	X	X	X
3.2 NRAP Toolkit Assessment	10/01/2020 03/31/2023													X	X	X	X
4.0 Stakeholder Engagement and Public Outreach																	
4.1 Stakeholder Analysis and Engagement Plan	10/01/2020 09/30/2022								C					X			
4.2 Conduct Stakeholder Engagement and Public Outreach	07/01/2022 09/30/2023													X			
5.0 Site Characterization																	
5.1 Pre-Drilling Site Assessment	10/01/2020 03/31/2021	D												X	X	X	X
5.2 Obtain Permits for Field-based Characterization Activities	10/01/2020 06/30/2021													X			
5.3 2S and 3D Seismic Surveys	10/01/2020 03/31/2022													X	X	X	X
5.4 Analyses of Site Data for Class VI Permit Requirements	10/01/2020 09/30/2022													X	X	X	X
5.5 Policy, Regulatory, Legal, and Permitting Characteristics	10/01/2020 09/30/2022													X	X	X	X

Gantt Chart (cont.)

Table 6. Gantt Chart with Team Responsibilities by Task. Letters refers to milestones in Table 3.

#	Task Name	Start	End	Budget Period 1				Budget Period 2				Subawardees	Vendors
				2020	2021	2022	2023	Q1	Q2	Q3	Q4		
6.0 Drilling and Well Testing													
6.1 Design Well Drilling Program		10/01/2020	06/30/2022									X	X
6.2 Drill and Construct Stratigraphic Test Well		07/01/2021	03/31/2022									X	X
6.3 Well Testing and Data Collection		10/01/2021	09/30/2022									X	X
7.0 Storage Site Modeling													
7.1 Development of Conceptual and Static Model		01/01/2021	09/30/2022		H							X	X
7.2 Development of Dynamic Reservoir Model		04/01/2022	09/30/2022									X	X
7.3 Development of Geomechanical Model		04/01/2022	09/30/2022									X	X
7.4 Model Calibration and Updating		01/01/2021	09/30/2022									X	X
8.0 UIC Class VI Permitting													
8.1 Pre-Permitting Activities		10/01/2020	06/30/2022									X	X
8.2 UIC Class VI Permit Application		04/01/2022	09/30/2022			1						X	X
8.3 Permit Application Revisions		10/01/2022	09/30/2023									X	X
9.0 Carbon Capture Assessment													
9.1 Identification of CO ₂ Sources and Capture Technology		10/01/2020	03/31/2021									X	
9.2 Conduct Pre-Feasibility Study of Capture System		04/01/2021	09/30/2022									X	

Bibliography

- No peer reviewed publications generated from the project to date.